Preventing Device Related Infections

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Infection Preventionist
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Goal: To learn how bundled care practices are protective of patients

Objectives:

To understand the need for cohesive planning by healthcare workers in the healthcare processes to include patients with medical devices

To discover how Biofilm necessitates organized care practices designed to support bundled recommendations.

To gain an understanding that the CLABSI and CAUTI Bundled care efforts can have a positive effect on the patient with medical devices.

To assist the healthcare worker attendee to consider stronger commitment to the IHI bundled care processes

To understand how to calculate rates for the bundled practices using device days as a denominator instead of patient days

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Start with a Plan!

- JCAHO requires that we have a plan
- CMS requires that we have a plan
- Each state requires that we have a plan
- Each hospital needs a plan
- Each Infection Preventionist need a plan
- It is all about plan, plan, plan

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Does your plan include the following:

- Plans for prevention of infection?
- Is it specific?
- Does it include a narrative Overview, an ICRA, Risk Reduction Strategies, and a defined surveillance outline?
- Are introduction of "Reduction of Central Line BSIs" and Catheter Associated UTI bundles in that plan?

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IHI-Bundles

Can you imagine trying to move each of these pieces of lavender somewhere one piece at a time:

A "bundle" is an organized group of evidenced base practices that move care to a higher level in a group that has proven to reduce infections

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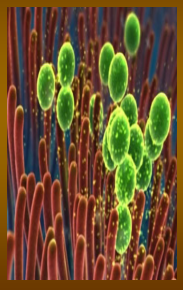
Before we discuss Bundles let us discuss why we need them:



Biofilm – what is it?

Deterioration of gums and jawbone that can eventually lead to loss of teeth (periodontal disease);

Middle ear infection familiar to millions of children and their parents (otitis media); and a fatal lung infection (cystic fibrosis pneumonia).

Develop on medical devices implanted in the body such as catheters (tubes used to conduct fluids in or out of the body), artificial joints, and mechanical heart valves.

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What is Biofilm?

Biofilm – what is it?

When implanted material such as a central line or a urinary catheter becomes colonized by microorganisms, a slow developing but persistent infection can result.

The infection can be nearly impossible to eradicate – multi-drug resistant.

Usually the implant must be removed, a procedure that is often costly, dangerous, and traumatic for the patient.

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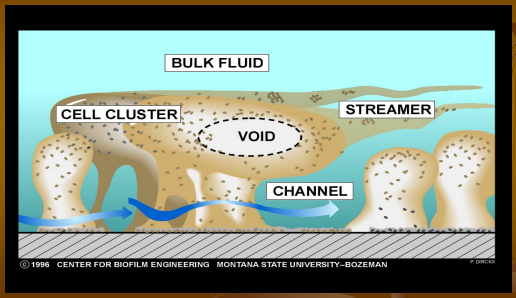
Schematic Representation of Biofilm



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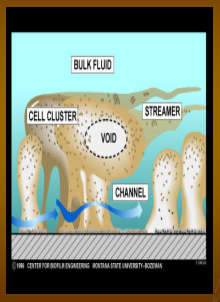
Schematic Representation of Biofilm



Biofilm is an attached (sessile) structure that can provide breeding grounds for multiple species of bacteria.

It is composed of both solid and channeled matrix material (polymeric) that allows liquid material to flow through.

It allows bacterial cells to cluster and reproduce, and move into the circulation

It is like a bacteria factory

It can reside on inert items, and dead or living human tissue.

It provides hiding and reproductive places for bacteria that protects them from antibiotic invasion.

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Where do we find Biofilm?

It is a very natural process –

If you are walking in a nice forest surrounded by beautiful green trees and you came upon this, would you shy away from it?

It is simply a close up of water flowing over rocks in a stream – this is biofilm

If you put a glass plate with a minimal amount of nutrient material on it and leave it under flowing water for a few weeks it would possibly look somewhat like this picture.

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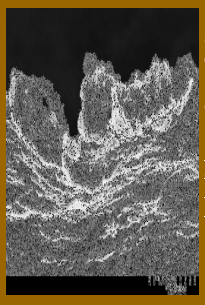
Where do we find Biofilm?



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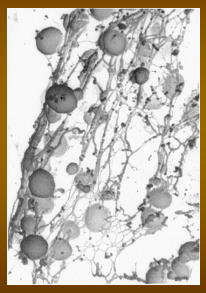
Implantable Material Colonization



When implanted material (medical Devices) becomes colonized by microorganisms, a slow developing but persistent infection results.

This micrograph shows a large number of *Staphylococcus epidermidis* cells covered with glycocalyx and adhereing to the surface of a catheter segment.

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Leukocyte Involvement

- There are a number of additional mechanisms which can lead to biofilm formation on implanted devices. A simple example is that leucocytes through the body's immune system can "find" the implant (medical Device), interpret the surface as a foreign material, and trigger the formation of a dense fibrin mat around the implant.
- This encapsulation can yield the device non-functional. Development of successful implants requires careful selection of materials, and in particular surface properties, such that the device will not be encapsulated by the body.

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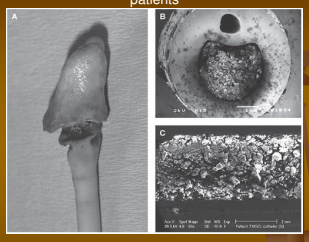
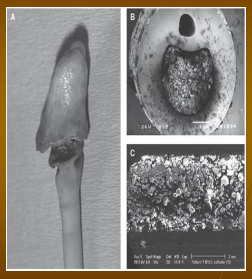
Figure 2 Examples of crystalline biofilms on blocked catheters taken from patients



Permission to reproduce Figure B obtained from Elsevier Ltd © Stickler DJ (1999) *Eur Urol Update Series* 5: 1–8.

Stickler DJ (2008) Bacterial biofilms in patients with indwelling urinary catheters *Nat Clin Pract Urol* doi:10.1038/ncpuro1231

nature CLINICAL PRACTICE UROLOGY



- **(A) This image shows a catheter that had been indwelling supra-pubically for 6 months. It was removed surgically. Crystalline material completely covered the eyehole and balloon of the hydrogel-coated latex catheter.**
- **(B) A cross-section of a silicone catheter that had been indwelling for 8 weeks. The image shows that the central lumen is occluded by crystalline biofilm. Permission obtained from Elsevier Ltd © Stickler DJ (1999) *Eur Urol Update Series* 5: 1–8. (**
- **C) A longitudinal section of a silver–hydrogel-coated latex catheter that blocked after 11 days *in situ*.**

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Biofilm Expertise:

- Marcia Ryder PhD, MS, RN began her session at the 35th INS conference in Phoenix, Arizona with a stark reminder.
- She told the assemble audience that during her one hour presentation something in the region of 30 people will die in the US of a healthcare associated infection (HCAI)!

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Hospital Acquired Infections?

- All HCAI's are a biofilm disease' and 'health care professionals need to re-think the basic things that we do'.
- Finally, Marcia reminded us that <u>100 trillion bacteria reside on our skin!</u>
- To read more about Marcia's work on biofilm we recommend that you read the following article… Ryder M.A. (2005) Catheter-related infections: It's all about biofilm. Topics in Advanced Practice Nursing eJournal. 5(3), posted 18/08/2005.

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Can I become Infected, Let me Count the ways!

At Insertion

✓inadequate hand hygiene

✓Improper barriers

✓Improper skin antisepsis

✓Improper post insertion maintenance

✓Improper technique for access for IV fluids

✓Improper length of indwell time

✓Improper placement – femoral, anticubital, subclavian, etc.

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IPs, We have a Problem!

Patients need the structure of Organized, evidenced base guidance to prevent infections;
The key components of the Central Line Bundle are:

Hand Hygiene

Maximal Barrier Precautions Upon Insertion

Chlorhexidine (CHG) Skin Antisepsis/CHG Disk use

Optimal Catheter Site Selection, with Avoidance of the Femoral Vein for Central Venous Access in Adult Patients

Daily Review of Line Necessity with Prompt Removal of Unnecessary Lines

Insertion Check List used for each insertion

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What to do to make it work?

- Empower nursing to enforce use of a central line checklist to be sure all processes related to central line placement are executed for each line placement.
- Include maximal barrier precautions as part of your checklist for central line placement.
- Keep equipment ready stocked in a cart for central line placement to avoid the difficulty of finding necessary equipment to institute maximal barrier precautions.

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Maximum Barrier Protection

- For the patient, maximal barrier precautions means covering the patient from head to toe with a sterile drape with a small opening for the site of insertion.
- Maximal barrier precautions clearly decrease the odds of developing catheter-related bloodstream infections. Two studies show that the odds of developing a central line infection were higher if maximal barrier precautions were not used.
- For pulmonary artery catheters, the odds ratio of developing infection were more than two times greater for placement without maximal barrier precautions.
- A study of similar design found that this rate was six times higher for placement of central line catheters.

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Maximum Barrier Protections

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Gaining Compliance

- Implementing a central line checklist at the time of insertion will help to ensure that all processes related to central line placement are executed for *each* line placement, thereby leading to a reliable process. (Standardization of Process)
- Nurses should be empowered to supervise the preparations using the checklist prior to line insertion and to stop the process if necessary.
- This checklist includes a list of activities that are considered standard work before, during, and after the procedure, as well as a safety checklist. It includes maximum barrier precautions and hand hygiene

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Scrub the Hub x 10!

- A poster used to remind staff to scrub the hub of a central line prior to accessing the line to instill medications or draw blood.
- Mechanical Valve ports with uneven edges – are they a problem? Latest research indicates that possibility.

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Scrub the HUB

Here's how you can prevent Catheter Line Associated Bacteremia (CLAB) in your patient!

Make sure you thoroughly scrub the injection port with alcohol before injecting IV medications.

Don't forget to "Scrub the Hub."

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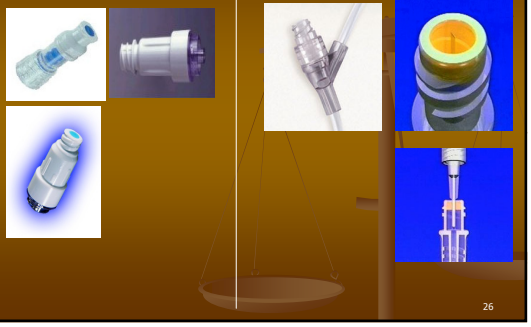
https://www.apic.org/Content/NavigationMenu/Education/AnnualConference/2006AnnualConference/Program/Handouts/C2201.pdf



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Mechanical Valve and BSI's?

- **Increased BSIs Temporally Associated With**
  the Introduction of A Mechanical Valve (MV)
  Needleless Device (ND)
- Hospital: University of Virginia (hospital-wide)
- Problem: Increased BSI rate after introduction of a MVND in May 2002

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Mechanical Valve/BSI Results

- By June 2002, nosocomial BSI rate increased 61%;
- January-May 2002 vs. May-December 2002: BSI rate: 2.2 vs. 3.5 per 1000 pt-days (RR=1.6, p<.0001)
- 2.9-fold increase in CR-BSI with common skin organisms.
- 1.8-fold increase in CR-BSI with non-skin organisms.\
- Hall K et al, SHEA Annual Meeting 2004

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Split Septum vs Mechanical Valve IV Ports

- **Increased BSI Rate Temporally Associated With Switching From A Split Septum to Mechanical Valve Needleless Device in a Long-Term Acute Care Hospital**
- *BSI rate per 1,000 catheter days; BSI rate has decreased since returning to a split septum needleless device.
- Salgado C et al. SHEA 2006, Abstract #7

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Research Review
William Jarvis, MD

- **Needleless intravascular devices (split-septum) were introduced to reduce HCW needle stick injuries.**
- **Initially, split-septum needleless devices were associated with BSI outbreaks, temporally associated with breaks in aseptic technique.**
- **Mechanic valves (leur-lock) needleless devices were introduced to reduce needle stick injuries and to reduce catheter occlusion.**
- **Look-alike devices and differences in infection control practices with each device complicate their use.**
- **Increased BSIs associated with mechanical valves may be caused by inadequate infection control practices, device design or both.**

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Determining a Central Line Infection

- Analyze all blood cultures from patients with central lines.
- Determine if a central line is in place during the time period in question
- Determine if there is an infection of the same organism at another body site – if yes, infection is secondary and cannot be counted as a CLABSI
- Is the patient febrile – leukopenic- site red or swollen, septic.
- If yes, review for central line infection

- Rate formula:

#Infections over a defined period of time
Divided by:
Number of Central Line Days* 1000

- Needs – a good method for collecting line days.

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URINARY TRACT INFECTIONS

CAUTI

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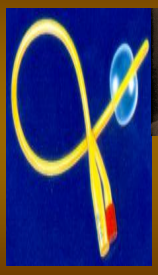
FOLEY CATHETER



The man!

Dr. Frederick Foley… invented the catheter in the 1930's.

They seem simple enough: soft tube, goes into the bladder, drains the urine, with a little balloon towards the end, inflated inside the bladder to keep it from slipping out.

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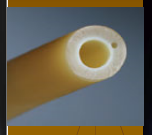
YOU MAY RECOGNIZE THESE



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FOLEY CATHETERS

Coude Catheter – note tip

What do you see in this picture above that can reduce catheter associated urinary tract infection?

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NHS - Scotland Bundle Criteria

Use a single column for each catheterised patient. Put a Check (✓)if achieved, or '*x*' if not achieved, in each box.

- **There is daily documented assessment of the need for the UC**
- **The UC has been continuously connected**
- **The patient is aware of his/her role in minimising the risk of developing a urinary tract infection, *or* daily meatal hygiene has been performed by nurses.**
- **Empty UC bag often, as a separate procedure, into a clean container**
- **Hand hygiene performed and disposable apron and gloves worn before & after procedure**
- **Action: Request Removal/Leave in situ**

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Credit to: June Collison MSN/Ed, BSN, RN, FCN and Kim Ryan BSN, RN, BC

Indications for Urinary Catheter

- ☐ Undergoing surgery on or near the bladder
- ☐ Chronic urology problems
- ☐ Relieve bladder outlet obstruction
- ☐ Relieve urinary retention
- ☐ Allow irrigation or drug instillation
- ☐ Requiring accurate assessment of urinary output

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UTI Bundle Components:

Perform Prudent Catheter Care

- ☐ Peri-care twice daily (morning and night)
- ☐ After each BM
- ☐ As needed for soiling
- ☐ Catheter Securement/Stat Lock
- ☐ No Tape

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Considerations

- ☐ Collect urine-use the sampling port
- ☐ Do NOT allow the bag to overfill
- ☐ Empty bag regularly, using separate container for each patient
- ☐ Urine catheter bag is NOT to touch the floor
- ☐ Access urine flow-Use bladder scan, rather than changing out catheter

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72 Hours- the magic time!

- ☐ The literature states up to 72 hours, or less for duration of catheter use
- ☐ Longer duration, increase likelihood of infection
- ☐ Notes placed on chart to assist in MD recognition of the number of days the catheter has been in place

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STOP-STOP-STOP

- Ask prior- "Stop, do we need this foley?"
- ☐ Ask **Every day**-"Do we need this foley?"
- ☐ Use a urinary catheter screen and carry over the date, so that is a visual reminder, as well as marking the bag

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Urinary Catheter is NOT

- ☐ For patients that are incontinent (unless wound present)
- ☐ Immobility (unless wound present)
- ☐ Obtaining urine samples (unless ordered)
- ☐ Patient request as it will be convenient (unless terminally ill or comfort measures)

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UTI Bundle

- ☐ Sterile technique on insertion
- ☐ Maintain a closed system (red seal in place.
- ☐ Hand Hygiene-Hand Hygiene-Hand Hygiene

Maintenance:

- ☐ Monitor S/S of UTI
- ☐ Date bag on insertion
- ☐ Bag and tubing kept lower than bladder and straight (No dependent loops in the tubing).

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Additional – to consider

- Use urometer catheter kit as needed
- ☐ Insert ONLY when necessary
- ☐ Use a 16Fr or 18 Fr
- ☐ DO NOT disconnect the bag from the tubing unless ordered or indicated
- ☐ Change to Urometer, Use aseptic technique

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Calculation Rates for CAUTI

- **Review the Micro reports for all positive urine cultures**
- **Check the leukocyte esterase on the UA (this usually indicates a bacteruria if elevated).**
- **Check the colony count. Anything above 50,000 CFU's is suspicious except in neonates.**
- **>100,000 CFU's needs to be thoroughly reviewed.**

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Calculation Rates for CAUTI

- Check the patient's signs and symptoms
  - Fever, leukocytosis, change in smell or color of urine
  - Check if patient is medicated for UTI or not. Many patients are colonized and are not treated and have no symptoms.
  - Micro culture report does not always tell the show the entire picture.

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Rate Calculation for CAUTI

- **Does the patient have a urinary catheter during the time in question.**
- **Check the dates of the culture report and the catheter insertion/discontinuation dates.**
- **Remember – It is hospital acquired for up to 7 days post catheter removal.**
- **Check all of the items outlined in the previous slide.**

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Rate Calculation for CAUTI

- **Rate is calculated as follows:**

Total # of positive UTI's with catheters during a specific timeframe

Divided by:

Total # of catheter days per that period of time x 1000

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Sad Facts

- It's commonly said in the MICU that every patient with a foley catheter becomes uroseptic in the end…
- The same article cited says that 3 times as many nursing home patients die if they have an indwelling foley catheter, as opposed to those who don't.

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Thank you to:

Central Line Placement with pictures

- http://note3.blogspot.com/2004/02/central-line-placement-procedure-guide.html

https://www.apic.org/Content/NavigationMenu/Education/AnnualConference/2006AnnualConference/Program/Handouts/C2201.pdf

UTI Bundle Information

- http://www.gshssecure.org/nebraskacah/docs/11.20.2008_NNC_Handout.pdf

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